

# THE 2000 FIRST ROBOTICS COMPETITION

## TEAM UPDATE #5

Date: January 25, 2000

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### CLARIFICATION TO GUIDELINES FOR THE AUTODESK AWARD FOR EXCELLENCE 2000:

All entries for the Autodesk Award must incorporate the use of at least one Autodesk product in the development of the 30-second animation video that is submitted. The name of the Autodesk product and a brief description of how it was used are required on the Entry Form, in the "Software Use" section. Use of at least one Autodesk product is an Entry requirement.

Exclusive use of Autodesk products is not an Entry requirement. Since the challenge of the Award is closely aligned not only with FIRST, but also with real-world engineering and design, use of multiple technologies and products is recognized and encouraged.

Further questions should be directed by email to Autodesk, c/o either [laura.london@autodesk.com](mailto:laura.london@autodesk.com), or [carolyn.gavriloff@autodesk.com](mailto:carolyn.gavriloff@autodesk.com).

## FIRST NATIONAL COMPETITION

**EPCOT WALT DISNEY WORLD : APRIL 6 - 8, 2000**

### SHIPPING INSTRUCTIONS:

Freeman Decorating Company, as the exclusive drayage contractor, will receive crated, boxed or skidded materials at their warehouse. Shipments must be sent with freight charges **PREPAID. COLLECT SHIPMENTS CANNOT BE ACCEPTED.** TO check on the arrival of warehouse freight, please call (407) 857-1500, ext. 7329.

All freight must be received at Freeman Decorating's warehouse no later than: Monday, April 3, 2000 in order to be delivered to Epcot at Walt Disney World. The warehouse will receive shipments Monday through Friday during the hours of 8:00 AM - 4:30 PM.

All shipments must be clearly labeled with the following information:

**Freeman Decorating Company  
Hold for: FIRST National Competition  
2200 Consulate Drive  
Orlando, Florida 32837**

**Team Name:** \_\_\_\_\_ **School Sponsor:** \_\_\_\_\_ **Space Number:** \_\_\_\_\_

**All crates must be marked "One Way" if the team intends on making their own return arrangements.**

All shipments must have a bill of lading or delivery slip showing the number of pieces, type of merchandise, or weight. Shipments received without freight bills, or specified unit counts on receipts, will be delivered to team tables without guarantee of piece count or conditions.

**CERTIFIED WEIGHT RECEIPTS:**

Driver will be required to submit certified weight receipts when receiving shipments for unloading. Freeman Decorating reserves the right of refusal to unload such shipments until a CERTIFIED WEIGHT RECEIPT is presented. In the event no weight is indicated on the delivery documents presented, Freeman Decorating shall estimate the weight. If actual scale weight figures are submitted prior to the move out period, the estimated weight will be final and binding. All shipments received at the warehouse and show site are subject to reweigh.

Freeman Decorating will deliver all freight to Epcot on Tuesday, April 4, 2000. On April 6, 2000 FDC staff will return to the pit area to remove empty crates and store until the end of the Competition on Saturday, April 8, 2000.

**OUTBOUND SHIPPING AND HANDLING:**

Outbound materials will be moved from pit area to dock and reloaded on designated vehicles. To assist you with arrangements for outbound shipments, Freeman Decorating Company will have personnel with labels, bills of lading, and shipping information available.

**Note that Epcot Walt Disney World will not accept or store team robots/tool boxes. All shipments must arrive at our warehouse by Monday, April 3, 2000.**

**SMC PNEUMATICS UPDATE**

SMC will be shipping an additional package to teams with the CD mentioned at the Kick-Off.

**CORRECTIONS AND UPDATES TO THE MANUAL**

The following parts have been added to the Additional Hardware List as follows:

**Control System**

Terminal Blocks	Any amount, off-the-shelf, See Rule C31
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**Fasteners**

Endcaps	Any amount - if used to cap pipes
Pipe flanges	Any amount - if used to attach pipes

The following rule has been added:

- SC4. 4. The minimum score that an alliance can receive is zero points, no negative scores will be calculated.
- V4. Any ball that is returned to the playing field through the ball chute by the human player will count as a minor penalty.
- C31. Terminal blocks may be purchased from any supplier, but the proper gauge wire and current rating must be used. Custom terminal blocks are not allowed.

## **RULES QUESTIONS & ANSWERS**

- Q108. I want to further clarify the reacting against the pipe rule. If a robot is designed to squeeze balls between the pipes of the goal, as many did in Ladder Logic, it would seem it would have to accomplish it without touching the goal. It could not square up to the goal or it could not go against it to determine distance from it and it could not go against it to center on the opening between the pipes or it would be DQ'ed. Are these correct statements?
- A108. Incidental (inadvertent) contact with the goal in the process of squeezing balls between the rails is not against the rules. Designing mechanisms (levers, cams, v-alignment mechanisms, clamps, switches, etc.) that react to the presence of the goal or support a portion of the robot (such as from falling over) is a violation of Rule M7. Driving your robot until it bumps up against the goal is considered incidental contact, so you may design your ball handling system geometry to expect to be at a certain distance relative to the goal structure. If/when bumping the goal, please be careful not to apply large loads to the goal structure so as not to cause damage to the playing field.
- Q109. We are using the window motor and want to make a custom coupling to join the two shafts. Is this permitted as long as we use material from the Additional parts list? ex. steel round stock
- A109. You are welcome to fabricate your own shaft couplings and other parts using allowed materials. See Rule K2. However, steel round stock is not listed in the Additional Hardware List. Therefore, you need to use steel from the shafts in the kit or use steel round stock from Small Parts, Inc.
- Q110. Update 3 allows unlimited switches, so long as they are not illuminated. May we take the existing switches, or other non-illuminated ones, drill a hole in them and install the otherwise allowable LED's to make our own illuminated switches?
- A110. As long as the switch electronics (contact mechanisms, etc.) are not modified, it is okay.
- Q111. Update 1 states that we cannot make slip rings. You then point out that we can only use electrical terminals listed on the additional hardware list, which included ring terminals. Two ring terminals and a nylon bolt = one slip ring. Are we allowed to make slip rings if we use approved parts, or are slip rings strictly forbidden?
- A111. Ring terminals are allowed, and it is okay to connect them via a bolt (nylon or metal). (Think of the bolt as a fastener.) Therefore, it is okay to use them in that manner.
- Q112. Radio communication devices are not allowed to avoid interference. Would it be permissible for people in the crowd to use hand signals to signal our robot operators, as has been observed in the past?
- A112. Hand signals, yelling, etc. is okay. We aren't banning cell phones and pagers because they are so common that it is a practical impossibility, however, cell phone use on stage will not be allowed.

Q113. May solder be used in the construction of the robot? If so, are there restrictions on use, quantity, composition, or type?

A113. Yes, you may use solder to connect electrical components together. It is effectively considered a fastener. You may also use solder to fasten other parts of the robot together, such as pipe. Again, it would be considered a fastener (as is welding and brazing). You should not use so much solder that it becomes its own structure. The exact type of solder and composition (rosin core, acid core, lead/tin ratio, diameter, etc.) is up to you.

Q114. May we "treat" wire in order to coil it like a telephone cord?

A114. Yes.

Q115. Where can we find specs and the horsepower of the drill motors?

A115. See page 92 of The Robot section of the manual for the manufacturer's specs on the drill motor.

Q116. Are specs for the spikes available?

A116. Yes. Specs for all Innovation First products are on the Innovation First web site at: <http://www.innovationfirst.com/>

Q117. Is contact with the 30" cross bar under the goal with a micro switch or wire connected to a micro switch considered interaction with the goal if the propose is to protect the robot from damage?

A117. If the robot is designed to react with the goal, then it would violate rule M7. Rule M7 does not distinguish between a micro switch, a clamping mechanism, etc.

Q118. May we use the gyro sensor as an input to the Operator Interface?

A118. Yes.

Q119. May we modify the joysticks and use them as sensors on the robot?

A119. Yes. See C29 in Update #2.

Q120. We can take powdered nylon (or a mixture of powdered nylon and powdered copper) mixed with a powdered fixative (glue) and, using a "rapid prototyping machine" and CAD models, create a three dimensional assembly. May we create legal, usable robot subassemblies in this manner?

A120. Powdered nylon and powdered copper are not on the Additional Hardware List, so you would need to get the powders from Small Parts, Inc. or make them from the Nylon Rope and Copper Water Pipe that is listed on the Additional Hardware List. Glue is a fastener, so it is a freebie. Combining the powders and glue in this manner is allowed.

Q121. Last year I remember having a "generic" program for the robot that we could then customize for our particular application. I have looked everywhere for one for this year, but have not been successful. Do you happen to know how I could get it? Did it come on disk and I just have not been able to find it?

A121. The default control system program is available along with the rest of the control system documentation from Innovation First on their web site at <http://www.innovationfirst.com>.

Q122. Is Schedule 40 PVC adhesive permitted?

A122. Yes. Adhesives are considered fasteners.

Q123. Is the square fiberglass tubing in the Small Parts catalog considered "extruded fiberglass" under additional hardware? If so, is it then not included in your \$425 budget through Small Parts ?

A123. Yes, the fiberglass tubing from SPI is considered "extruded fiberglass", so you can use it without impacting your \$425 limit.

Q124. We have a question regarding the rack and pinion provided in the green and gray containers. Since the rack provided has a coarser pitch than anything sold in the small parts catalog, may we get racks that fit the pinions provided, from other sources?

A124. No. Racks are not listed in the Additional Hardware List, so you can't purchase them from another supplier. You are, however, welcome to fabricate a new rack from allowed raw materials.

Q125. We are looking at extruded aluminum supplies from a vendor. Available from the vendor are also various kinds of fasteners including what the vendor refers to as clamps, angle-bolt connectors, right-angle connectors (gussets), junction connectors, connection links, etc. Are these items legal? Do these items fall under the "fasteners" (or some other category) of the Additional Hardware list?

A125. It sounds as if these items would qualify as "joining plates for extrusions", which are on the Additional Hardware List. If these plates have moving parts (hinges, linear bearings, etc.) then they do not qualify as joining plates.

Q126. If our machine should attempt to block an opponent's machine from scoring by blocking a portion of the top of the goal and our machine should touch (not grab or secure) the top of the goal and/or be pushed onto the goal by the opponent's machine or ball, does this violate any rules? Please clarify.

A126. As long as the blocking mechanism does not normally rely upon the goal for support (i.e. you could deploy it without tipping over), then contact during a shoving match would be considered incidental contact and would not be a violation of the rules.

Q127. In the course of extracting balls from underneath the cradle, if a robot makes contact with a pipe in the cradle, is this legal?

A127. Inadvertent contact with the goal is okay. Designing the robot to "react" with the goal structure, such as to provide support to the robot, is not.

Q128. We have a need to locate motors on a portion of the robot that rises with a telescoping mast or extending arm. Specifically, we want to use a drill motor and/or a window motor. Since we saw that we could not develop and use a sliding brush arrangement to transmit power, we would have to use power cables. Can we simply buy rubber-coated multi-conductor wire (under "wire" in the Additional Hardware List) of the appropriate gauge and use that? If we got such wire with 4 conductors (10 gauge), could we run power for both motors through it?

A128. You are allowed to use jacketed multi-conductor wire as long as it is of the proper gauge. However, please try make sure that the wire colors are reasonably visible at the ends so that the inspectors can verify which Speed Controller or Relay Module is connected to which motor.

Q129. Are we limited to the use of the 'Exide' brand batteries in the competition, or may we use the one's from last year's kit?

A129. You must use the Exide/Yuasa batteries provided this year during competition matches. You may use the CSB batteries for prototyping and in the pit area.

Q130. May we use motors from previous years' kits as spares, specifically the window, seat, and van door motors?

A130. The seat motors are different this year, so no for them. Depending on the year, some old window motors had a different output gear/pin dimension, so no if they are different, but yes if the dimensions are the same. You may use last year's Tiagene van door motor, but not the Bosch van door motors.

Q131. We are allowed to use up to 10 'Skyway' wheels. May we use the 3/8" bearings which are supplied with those wheels, even though we may not use the wheels themselves?

A131. Yes. You may remove the bearings from the wheels and use them separately.

Q132. The Additional Hardware Lists says "Control System, Switches: Any amount, Any type, non-illuminated." Does this allow the use of proximity switches on the robot?

A132. The intent is pushbutton, rocker, rotary, limit, etc. switches. Powered devices, such as optical switches, hall-effect switches, etc. are not intended.

Q133. A76. said we can prototype with any hardware but the final product must come from SPI if it is not on the Additional Hardware list. The specific question addressed a manufactured device - a linear slide. Does this also include raw material that we use for fabrication such as 1018 steel bar stock? For raw materials like this, can we use our own supply on hand and account for the cost according to SPI catalog prices and count it against our \$425 limit?

A133. If it isn't in the kit, and isn't on the Additional Hardware List, then we do expect that the material is from Small Parts, Inc. Steel plate (up to 1/4" thick) is on the Additional Hardware List, so if by "bar stock" you are referring to plate and not rod, then you may be all set.

Q134. We have an arm that reaches into the goal and lifts out balls. Does the 10 second pinning rule apply if another team comes along and pins our arm down to the goal?

A134. Rule DQ7 disallows pinning against the goal, so it would apply to this situation. However, it would be legal for another robot to block the removal of your mechanism from the goal as long as they do not hold your robot against the goal. That is, they could hold part of their robot just above yours and the two of you would have to "arm wrestle".

Q135. Please send me some blue prints for my robot. I received the 2000 FIRST robotics kit and I am having difficulty assembling it due to the lack of straightforward instructions. I would also appreciate if you could give me any tips on what materials I need for the body.

A135. There are no blueprints for assembling the robot. Part of the challenge of the FIRST Robotics Competition is for each team to come up with a unique robot design that utilizes the parts provided in the kit, parts available from Small Parts, Inc. and parts available from the Additional Hardware List. Please review the manual provided by FIRST, especially the section titled "The Robot", to acquaint yourself with the rules governing robot construction. You may find the following additional web resources helpful when designing your robot:  
<http://www.innovationfirst.com> - contains manufacturer's specifications for the robot control system  
<http://sharingfirst.mit.edu> - a site for teams to share tips on robot design and other topics  
<http://www.chiefdelphi.com> - has on-line discussion forums for all teams

Q136. Some of our team members suggest we should lighten the very heavy air tank by drilling it full of holes. Would this be legal?

A136. No. See Rule M16.

Q137. This year we were not provided with any optical sensors. We still have our sensors from last year. I was just wondering if we are allowed to use those sensors.

A137. Unfortunately, we were not able to get more of the optical sensors, so there were not included in the kits this year. They are not on the Additional Hardware List, so they are not allowed this year.

Q138. If we are going to construct our own bolts and screws and such from raw materials to use as fasteners, can we count this as free? We need to make some custom ones and were wondering if this would qualify under the fastener rule, or if this would go against our raw materials allowance.

A138. You may fabricate a custom fastener and count it as a fastener per the Additional Hardware List.

Q139. What pressure will tanks be charged to by SMC? We have found nothing in the manual, but one team member thinks they said 110 pounds at kick-off.

A139. SMC will charge the tanks to 110psi  $\pm$  5psi at competition events.

Q140. In the rules, it is mentioned that we are allowed to use wireless video equipment on our robot with permission from FIRST. A) How do we receive permission from FIRST? B) Does the cost of the camera count towards our cost limit for the robot? C) Are we allowed to place a monitor in the alliance station? E) What frequencies would be available to us?

A140. To receive permission, contact one of the FIRST engineers supporting the FIRST Robotics Competition, send us the specs of the radio system that you are considering using, and we will clear it with the Innovation First folks to make sure that it won't interfere with the wireless robot control systems. The cost of your camera system does not matter because it is considered a "non-functional decoration". The monitor may not be placed in the alliance station because that might give your alliance an unfair advantage. As for frequencies, you need to avoid the 900 MHz band, because that is used by the robot control systems.

Q141. Rule DQ8 seems to imply that cell phones may be used anywhere in the competition area. Does this allow the use of cell phones on the playing field? What about during matches?

A141. Cell phones may not be used in the alliance stations or in the immediate vicinity of the playing fields. Cell phones may be used in the audience, pit area, outside, etc. If we find that cell phones are causing problems with the robot control systems (they shouldn't) then we will ask all present at the event to refrain from the use of cell phones.

Q142. May we keep the control system, or do we have to ship it with the robot? We would like to keep it so we can practice until the regionals.

A142. The control system is part of the robot and must be shipped to the event site with the robot. If you wish to have a control system to practice with during the interim, you may purchase an additional system from Innovation First on their web site at <http://www.innovationfirst.com>.

Q143. With respect to A92, may we shorten the mounting bolts on the bottom of the light?

A143. It is acceptable to shorten the mounting bolts. The red power lead may also be modified in order to connect the light to the control system. A92 was intended to cover the metal base housing and colored plastic dome.

Q144. May team members in the stands communicate the score to the alliance station via whiteboards, chalk boards, or even yelling?

A144. Yes, but please be considerate to those around you in the audience.



Q145. Are we allowed to have speakers attached to the robot's shipping crate? Also may we have the speakers on in the pit and while entering and exiting the competition arena?

A145. No. See Rule P14 (in Team Update #3). Also, your shipping crate will not stay with you for the duration of the event. It will be collected after you uncrate your robot on Thursday and returned on Saturday so that you can repackage your robot. We can't leave the crates in the pit area because they take up too much room.

Q146. Some people on our team have tinted safety glasses, is that acceptable?

A146. Yes, but they have to be safety glasses, not just sun glasses.

Q147. If our opponent is throwing a ball of theirs into their goal, may we throw one of ours to set it off its course?

A147. Yes.

Q148. May we use a shaft from last year's robot, or must we manufacture a duplicate?

A148. No. See Rule M17.

Q149. Is there a limit as to how much can be welded?

A149. Welding is considered a fastener, so it is not limited. However, do not melt so much welding rod as to create a structure unto itself.

Q150. We were donated some quarter inch plate for building parts. Upon measuring this plate, however, it is tooling plate, and measures in thickness 0.260 inches pretty consistently. Can we interpret the rule of 1/4 plate in the additional hardware list as  $0.250 \pm 0.015$  as a machinist would, or is 1/4 to be interpreted as  $0.250 + 0.000$ .

A150. If the plate is sold as (advertised by the vendor as) 1/4" thick, then it is okay. If it is sold as some dimension  $> 1/4$ " thick, then it is not.

Q151. In an earlier question regarding extrusions, you stated the tubes and joining plates were OK, but disallowed the hinges and slides. I emailed 80-20, and they assure me that the hinge mounts and the bearing details are indeed extruded parts, and the furthermore they can be purchased in bulk, basically in the "as extruded" condition and made into hinges and slides with a small amount of sawing and a couple of drilled holes. Is that allowed?

A151. If you purchase the parts as extrusions, and then modify them to create hinges or slides, that is okay.

Q152. Are we allowed to modify the gearboxes on the Globe motors? They are not listed as ones that we can modify but their gearbox does not appear to be integral.

A152. Yes, the Globe motor gearboxes may be modified. However, we will not provide free replacement of parts which failed due to modification.

Q153. May we put a capacitor across the drill motor?

A153. Capacitors are not included in the kit or the Additional Hardware List, so they are not allowed. You should not need them this year.

Q154. How many balls can a robot take with it to score?

A154. There is no rule limiting the number of balls that a robot may hold.

Q155. We were contemplating using steel axles for our robot but did not see any mention of steel in the additional hardware list. Could you possibly tell us how we could justify using steel axle material?

A155. You would either need to use the steel shafts provided in the kit, purchase steel rod from Small Parts, Inc., or purchase raw steel (steel plate is on the Additional Hardware List) and melt and recast it into a rod.

Q156. May we wrap belting (conveyor, timing, leather, etc.) around our wheels to improve traction, if it is not used to transfer power from the motor to the wheel?

A156. Yes.

Q157. May we use a piece(not a complete loop) of non-SPI belt on grippers to increase friction?

A157. Yes.

Q158. Are we allowed to add a heavy "bumper" to our robot in order to lower our center of gravity?

A158. The weight of the bumper is considered part of your overall 130 lb. limit. If it otherwise meets the requirements of Rule M3 then it is allowed.

Q159. Here's the scenario: Our robot lowers a ramp to the ground for our ally to drive onto for 10 points. Our opponent seizes the opportunity and drives on our ramp instead. Are we allowed to lift our ramp back up, and in the process tip our opponent on their back? This all assumes we did not try to tip our opponent in the first place, but were only trying to let our ally on the ramp.

A159. Yes, you may attempt to lift your ramp, because the intention is to get your opponent off your the ramp and not to purposely tip or elevate your opponent.

Q160. Do any of the suppliers that are listed in the manual carry bumpers that we can use for the Robot?

A160. We do not know of any manufacturers which stock bumpers that meet the specs stated in Rule M3. The intent is for teams that wish to use bumpers to fabricate their own.

Q161. In the rules for this years competition it is stated that we are able to use metal, but it doesn't specify the kinds. are we able to use aluminum sheet metal. or maybe are we able to use the metal that duct work is made up of, I think it is aluminum, but it is made of a couple different kinds of material.

A161. Please read The Robot section of the manual for rules governing robot construction.

Q162. We are interested to know if you can design or incorporate the robot to have detachable electrical connections. For example: If we are raising and lowering a basket in the competition, that has motor or mechanism on it that uses electrical power supplied by the battery. Would it be legal to trigger another device or mechanism that would one time unplug the electrical connection in a safe manner disabling the device for the rest of the match, so we could choose not to lift the basket when we try to hang from the bar.

A162. Detaching an electrical connector during a match does not violate any rules. However, you should be careful not to leave any exposed conductors which might cause a short circuit, and make sure that detached wires do not pose a risk of entanglement. Also, make sure you use only electrical connectors that are allowed per the Additional Hardware List.